Focus Groups: Early Earth

Chairs:	***Ariel Anbar , Roger Buick , Stephen Mojzsis***

Project Progress

EXECUTIVE SUMMARY: MISSION TO EARLY EARTH FOCUS GROUP

The search for life beyond Earth requires understanding the conditions under which life originates and evolves, the factors influencing the emergence of complex life, and the ability to interpret the “fingerprints” left by primitive biospheres on the geologic record or in the atmospheres of extrasolar planets. Such understanding must be informed by examination of the history of the only planet on which life is known to exist—the Earth. Hence, study of life and the environment on the early Earth is a critical aspect of astrobiology research.

The aim of the Early Earth Focus Group is to facilitate collaborative activities centered on this topic that bring together researchers from multiple NAI teams as well as researchers from outside the NAI (including researchers based outside the U.S.). To this end, the group currently includes approximately 120 researchers (roster submitted in previous years' reports). These individuals all actively requested membership in the group.

The primary activity of the group over the past four years has been to develop the case for organized stratigraphic drilling of ancient sedimentary intervals of unique astrobiological interest—a “mission to early Earth.” To this end, the group sponsored a series of meetings and a field expedition, and ultimately proposed a “Deep Time Drilling Project” to begin with a set of three pilot drill cores in the Archean stratigraphy of Western Australia . These activities helped spur the creation of the NAI's Astrobiology Drilling Program (ADP) in Fall, 2003.

Major ongoing activities coordinated by the focus group include:

• Advising the NAI Director and the ADP Steering Committee in the development of guidelines for the acquisition, curation, and distribution of samples acquired under the auspices of the ADP.

• Planning the recovery of cores from Western Australia in Summer, 2004, with support from the NAI under the aegis of the ADP.

• Leveraging NAI support by seeking funds from other agencies. Most notably, the investigators leading the Western Australia project prepared a successful

$500,000 proposal to the Geology & Paleontology program at the National Science Foundation (NSF) to support research on the km–long Hamersley Basin drill core that will be recovered in Summer, 2004.

With the creation of the ADP, the “operational” aspects of the focus group are being relocated to an administrative committee (the Astrobiology Steering Committee) overseen by the NAI Director. This is an appropriate evolution, the net result of which will be that the future activities of the focus group will center on advisory/outreach functions rather than “mission planning”. Consequently, it was proposed that the name of the group change from “ Mission to Early Earth Focus Group” to “Early Earth Focus Group.” The future activities of this refocused focus group remain to be developed.

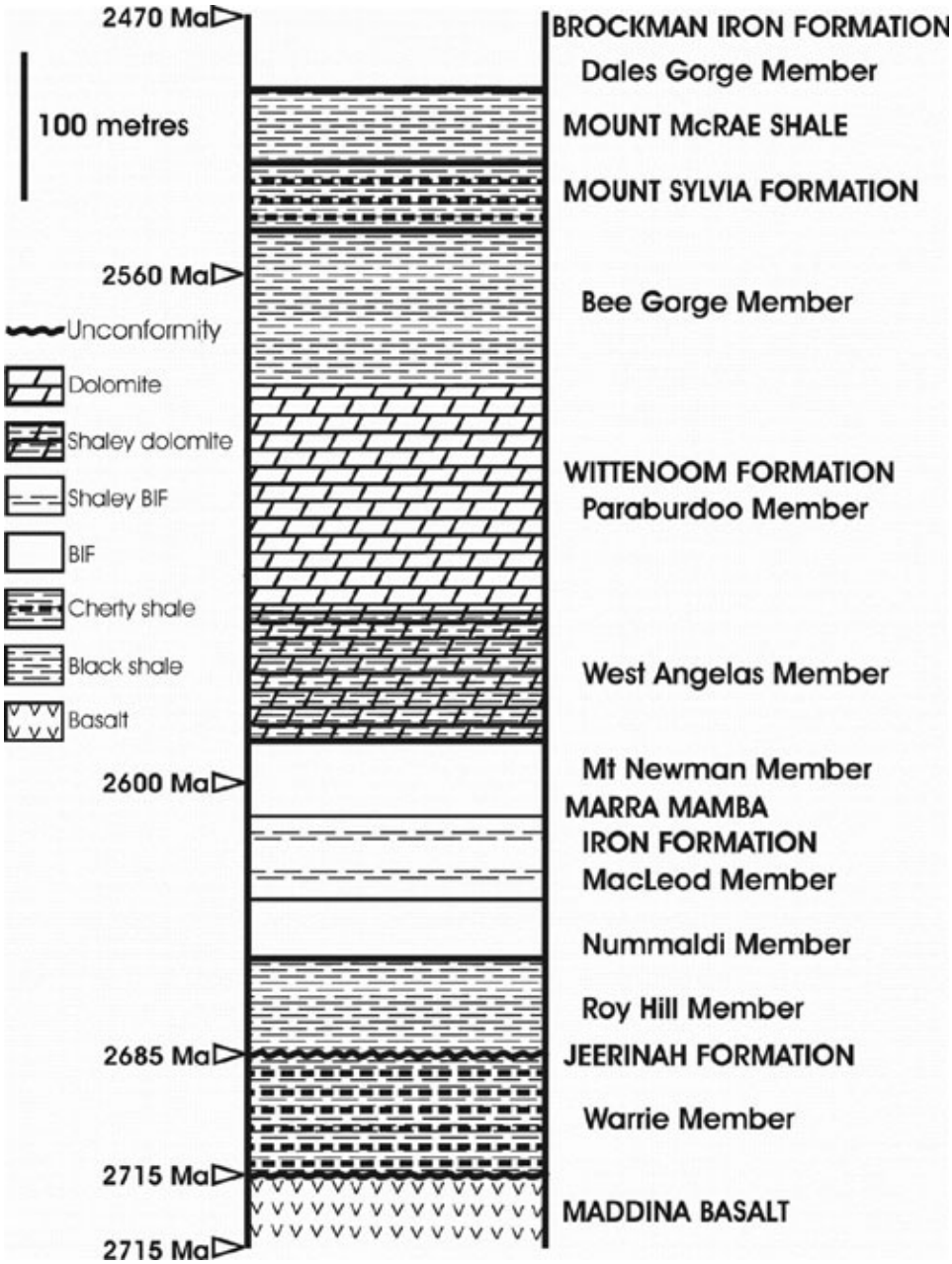
FOCUS GROUP DESCRIPTION & ACTIVITIES

Year 6 activities were dominated by preparation for the Summer, 2004, drilling activities of the Deep Time Drilling Project that emerged from the Focus Group. This project is described in considerable detail in the Year 5 report, and so will not be repeated here. The primary activities involved budgeting and fund raising.

In late 2003/early 2004, a detailed proposal for funding recovery of three drill cores was prepared by Roger Buick, submitted to and approved by the NAI. The total amount requested and allocated was $275,000. A collaborative model was developed in which the Deep Time Drilling Project would work jointly on some of these cores with the Archean Biosphere Drilling Project led by Munetomo Nedachi and Hiroshi Ohmoto.

In early 2004, a related proposal was submitted to the NSF. This proposal sought $500,000 toward initial research on the planned km–long Hamersley–Fortescue drill core, emphasizing characterization of biology and environment in the late Archean. Principal Investigators (PIs) on this proposal were Ariel Anbar, Roger Buick, Alan Jay Kaufman, Andrew Knoll, Timothy Lyons, and Roger Summons. This proposal was recommended for funding in August, 2004, shortly after drilling commenced.

These activities constitute an unusual and successful collaboration between NASA and NSF, and between different drilling teams.



Stratigraphy to be sampled by the 1 km drill core of the Deep Time Drilling Project. These pristine sediments sample the last ~ 250 million years before the rise of oxygen– the last days of the Archean biosphere.

Highlights

- Sampling of early biosphere begins

Roadmap Objectives

- ***Objective No. 1.1:*** Models of formation and evolution of habitable planets
- ***Objective No. 4.1:*** Earth's early biosphere
- ***Objective No. 4.2:*** Foundations of complex life
- ***Objective No. 4.3:*** Effects of extraterrestrial events upon the biosphere

- ***Objective No. 5.2:*** Co−evolution of microbial communities
- ***Objective No. 6.1:*** Environmental changes and the cycling of elements by the biota, communities, and ecosystems
- ***Objective No. 7.1:*** Biosignatures to be sought in Solar System materials

Field Expeditions

Field Trip Name: Deep Time Drilling Project	
Start Date: June, 2004	***End Date:*** August, 2004
Continent: Australia	***Country:*** Australia
State/Province: Western Australia	***Nearest City/Town:*** Marble Bar
Latitude:	***Longitude:***
Name of site(cave, mine, e.g.):	***Keywords:***
Description of Work: Drilling of three drill cores of the Deep Time Drilling Project	
Members Involved:	